The Book of the Add Add and JESSEY.

EOS, TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

VOL. 62, NO. 34, PAGES 633-848

AUGUST 26, 1981

INVENTORY GLEARANCE SAVE S

Antarctic Research Series

Lipper Atminspliere Research in Anterctica (1978), edited by d.L. Lanzerotti and C.G. Park, 275 pages, illustrated (Catalog No. AR2900], \$47.00, \$24.00

Anthrotic Oceanology II: The Australian-New Zeafand Sector (1972), edited by D.E. flayes, 364 pages, illustrated folded maps, (Catalog No. AR19(0)), \$32.00. \$17 (0)

Antarctic Snow and ice Studies II (1971), edited by A.P. Crary, 412 pages, flustrated, [Catalog No. AR1600], \$24.50, \$12.00

Antarctic Oceanology I (1971), edited by J.L. Reid, 343 onges, illustrated, color, folded maps, (Catalog No. AR1500), \$22 (X) \$11.00

Studies in Antarctic Meleorology (1966), edited by M.J. Rubin, 23t pages, illustrated, (Catalog No. AR0900), \$14.00 \$7.00

Geomagnetism and Aeronomy (1965), edited by A.H. Waynick, 236 pages, Wustrated, (Calalog No. AR0400), \$10.00-\$5.00

Antarctic Snow and Ice Studies (1964), edited by M. Mellor, 277 pages, illustroled, foldouts, (Catalog No. AR0200).

Meterological Studies at Pfeteau Station, Aniarctica (1977), edited by J.A. Businger, 155 pages, illustrated, colo

Papers 1 through 4, (1977), 39 pages, \$10.40. \$7.20

Paper 1, Micrometeorological System Installation Performance and Problems, by Paul C. Dairymple and Leander A. Stroschel Paper 2, A Year of Snow Accumulation at Plateau Station, b Uwe Radok and Robert C. Lile

Paper 3, Thermsl Properties and Heat Transfer Processes of Low-Temperature Snow, by Gunter Weller and Peter

Paper 4, Radiative Heal Transfer Processes in Snow and ice, Peter Schwerdtleger and Gunter Weller

Paper 5, The Rodintion Budget et Ploteau Station, Antarctics 1966 - 1967, (1977), by M. Kulin, L.S. Kundla end L.A. Straschein, 36 pages, \$13.00, \$9.00

Papers 6 through 8, (1977), 51 pages, \$10.50, \$7.25

Peper 6, Air Tempereture and Two-Dimensional Wind Profil In the Lowest 32 Meters as a Function of Bulk Stability, by H Lettou, A. Riordan, and M. Kuhn Paper 7, Stability-Related Wind Spiraling in the Lowest 32 Meters, by M. Kuhn, H.H. Lettau, and A.J. Riordan Peper 8, Variations of Temperature and Air Motion in the 0- to 32-Meter Layer et Plateau Station, Aniarctica, by Allen J.

Paper 9, Optical Phenomena in the Antarctic Atmosphere, (1978), by Michael Kuhn, 27 pages, 28 color pletes, \$10.00 \$7.00

Please see the terms and conditions of sale on the reverse page

	CLEARANCE SALI ER FORM	_
Entire order must be shipped to one address	Date	
	USE	NLY
	Aug. 1, 1981-	-Oct 1
Ship to:		
	-	
IPLE	ASE PRINT)	
Title/Author Qty. or Catalog Number	Unii	
or caralog (number	Price	
		
		
There is no additional by		
There is no additional disco		
There is no additional disco	Handling	
on sale priced publications	Handling Grand Total	
on sale priced publications Minimum order \$10.00 a. en co	Handling Grand Total	\$5
on sale priced publications Minimum order \$10.00 + \$2.50 All orders under \$100.00 trust by	Handling Grand Total Dhandling Sprepald	
on sale priced publications Minimum order \$10.00 + \$2.50 All orders under \$100.00 must b	Handling Grand Total	
on sale priced publications Minimum order \$10.00 + \$2.50 All orders under \$100.00 must b	Handling Grand Total Dhandling Sprepald	
Minimum order \$10.00 + \$2.50 All orders under \$100.00 trust b	Handling Grand Total I handling Prepaid Bill me Jorders over \$	
Minimum order \$10.00 + \$2.50 All orders under \$100.00 trust but the content of th	Handling Grand Total handling pe prepaid D Bill me Jorders over \$	
Minimum order \$10.00 + \$2.50 All orders under \$100.00 must be considered by VISA Correct Card No.	Handling Grand Total I handling Prepaid Bill me Jorders over \$	
Minimum order \$10.00 + \$2.80 All orders under \$100.00 trust E Check Enclosed VISA Correct Card No. Inter Bank No. Signature	Handling Grand Total I handling Prepaid Bill me Jorders over \$	100.0

Editorial

Personal Journal Copies Are in

will individuels be eble to continue to purchesa AGU ioumala? Is it possible thet practices et your institution ere andangaring your own subscription to AGU journala? As a member of AGU you heve the privilege of subscribing to journals for your own pereonel use et extremely low rates. When you eccept journels et the member retes, you are agreeing that these lesues will not be used in libreriea or reading rooms for et leest 2 yeers from the date of publicallon. This policy is cleerly steted when you place or renew your journal subecriptions. The finencial atability of AGU and its publicationa program depends on each member's honoring this understending.

AGU journela ere finencially supported by page charges and library eubscriptions. Librery eubscriptiona must be griced to make up the difference between expensee end page charge revanues beceuse member journals ere giced at little more then the coet of paper, presswork, and postaga for en incrementel copy. AGU muat derive enough revenua from circulation to keep dependence on page charges at e reesoneble level. Librery use of journala et membar retes could leed to total dependence on page charges. Total dependence on page charges would require a significent increase in the page charge rate and would mean that AGU could publish only papere thei were peld for. The only elternetive is increesed member subscription rates, which would result in e sharp drop in distribution end, therefore, e decreeee in ecceee. It is essential both to the scientific integrity of AGU journals and to their finencial health that librariaa aubacribe at the institutional subacription rala rather then use members' coplea.

Institutionel aubscriptiona to AGU journels may appear to be expensive, but they ere not. Compere the subscription iate par page for JGR with thet for any journal published by Esevier, Springer, or Reidel. In 1982 your library will probably recalve ovar 10,000 peges of JGR, eech paga of which contains batween 2 end 3 times the meterial on the averege pege of e typical commercial publication. On e par word basia, tha subacription rete to JGR is es little as onatenth that of meny commercial publications. And yet citation statistics tastify that AGU publications are very high emong the leadara in sciance.

Your assistance is imperetive if AGU is to continue to disseminete the highest quelity journals to the broadest possibla eudlance. Renew your own personel subscription, and find out whether your institution subscribes to AGU journals. If your institution does not now subscribe, please persuade them of the Importance to do so. The result will be a continuing bergein for you end your inelitution.



The Weekly Newspeper of Geophysics

Editor A. F. Spilhaue, Jr.: Associate Editors: Claude J. Allegra, Peter M. Ball, Kavin C. Burke, Arnold L. Gordon, Krisline saros, Garard Lachepalla, Christopher T. Russell, Richerd A. Smith, Seen C. Solomon, Cerl Kleelinger, News Writer: Berbare T. Richman, Editor's Assistant: Sendre R. Merks, Eos Prolustion **Staff:** Patricle Bengert, Mergeret W. Conelley, Eric Ger-ison, James Hebbiethweite, Dae Sung Kirn, Micheel Schwertz.

J. Tuzo Wilson, Preeldent; Jemes A. Ven Allen, Preeldent-Elect; Lesis H. Meredith, General Secretary; Carl Kleelinger, Foreign Sec-felary; A. F. Spilheus, Jr., Executive Director; Weldo E. Smith, Exec-

Advertising their meets AGU etandarda ia eccepied. Contact Robin E. Little, advertising coordinator, 202-462-6903.

For, Transections, American Geophysical Union (ISSN 0096-3941) spublished weekly by the American Geophysical Union from 2000
Porids Avenue, N.W., Weehington, D. C. 20009. Subscription evellable on request. This issue \$5.00. Second-cless postage paid at Mashington, D. C., and at edditional mailing offices.

Copyright 1981 by the American Geophysical Union. Melerial pub-ished in the issue mey be photocopied by individuel scientists for research or standard to use short Research or cless room use. Permission is also granted to use short quotes and ligures and tables for publication in scientific books and increase. purals. For permission tor any other usee, contact AGU Publications ications Office, 2000 Florida Avenue, N.W., Washington, D. C.

Views expressed in this publication ere those of the euthors only end do not reflect official positione of the American Geophysical Union unless expressly stated.

Cover, The AVHRR thermel infrered image (11 µm wavelength) was obtained from the NOAA-8 poter orbiting selelitie on December 11, 1980, et 0947 GMT. The image was processed by Richard Legeckis at the Netional Eerth Satellite Service in Washington, D. C. The Eest Australian Current, one of the live major wastern between the control of the control Western boundary currente in the world, eppeare as a relatively warner (darker) band of water that is moving courtived along the Australian court is the proving courtive profits. an coasiline. Neer ledtude 35°S, the current lums northward in a counter-clockwise loop. Detached meenders and werm out addless are evident sestivard of the current. According to decige Cresswell of the CSIRO Marine Leboratories in Australia, the current. the current was surveyed during this period by alrest, ship, and Ming buoy measurements. Each line of longitude and lallitide is !" (Photo submitted by R. Legeckie, Netional Earth Satellite Set

News

Statue of the Grünelsen Constant

As a apecial workshop at the recant moeting of the internalional Association of Setamotogy end Physics of tha Earth'a Interior (IASPEI) in London, Onlario, geophysicist H. H. Schloassin organized a sequenca of diacussions on 'gamma,' tha tharmodynainic parematar first darivad in 1926 by E. Grünelsen. Tha Grünelsen parametar is known to ell geophysicisis es tha less then parfect constant lhei reletas voluma and thermal anergy properties of a substanca in geophyaicel eystams et high pressura, ranging from shock-weve anvironments to that along the temperature gradient of tha aarth's lower manila end cora. Derivations and epplications of Grünelaen's gamma leen heavily on tha tundemantala of quantum end stallslicel physical thaory. The nacesaery simplicity of the alomic systema for which the scopa of the thaory epolias, and the incradibla comptaxity of its very theoreticel besis, have saverely limited gamme'a practicelity for most aubstances. Furthermore. The geophysical litereture is always ebraaat of the latest cases where e given epplication of gemme has agein tellad.

Why, Ihen, does e concept of such appearnt tanuity persist? The answar could be made apparent only etter considarable esotaric discussion by gemma experts at the IA-SPEI workshop. New reasons to think gemme is less than constant at high tamperature and prasaure wara provided, as uaual. Also, as usuel, il was clear that gamma survivas egain in geophysica, status quo.

Tharmodynamicelly, the Grünelsan parametar is a firstlaw ralellonship. Stellslically, if the Debye Ihaory assumption that eech of the vibrational frequencies of the normal modas of crystata very in proportion to the invarsa gammn (y) power of the volume, then $\gamma = (d \ln v^{\text{trace}}/d \ln V)$ whera I max is the limiting value of the frequency apectrum of a aolid, and V is the specific volume. Translating Ihis to tharmel-volume terms, $\gamma = (\iota \iota V \beta C_V)$ where α is thermal expansion. (1/V) $(i(V/i)(T)_{P_1})$ is the compressibility $-(1/V) (\partial V/\partial P)_{T_1}$ and C_V is the heat capacity et constent voluma. It turns out that meny essumptions of both theories are unjustitied (for one, contributions of the alactronic (requencies of a crystal must be considered as wall as thermal frequencias), and the interprotations become complex.

The reeson that gamma continuas to ba so hardy and rasistant to heavy crificism is that it appaors in many equations of stata (i.a. tha Mid-Grünaisen equation); it eppears in the most valuable aquetions of stata for materials at high tamparelures end prassuras. Whether gamma is a universal consient or not undar the antire range of temperatures end pressures within planetary interiors is not important so long as it cen be evaluated within carlain structural regimes. Two independent approaches to the theoretical-ampirical evaluation of the Gruneisen paramater wora described in seperate discussions at the workshop by O. Andarson and D. Stevenson. A good portion of the discussion was devoted to anelysis of whare the approximations wera not justified end to aquations of stete with and without gamma. Nonetheless, the discussions tett the concept of gamma batter understood end ralatively unscathed.

It was eppradeted et the workehop thet there are severef considerations about gamma, whether II la to be avaluated for upper- or lower-mentle conditions or for the liquid or solld core. Asida from daducing gamma from theory and from gaophyaical data, new mathoda ot measuring gemme of metariala in the laboretory were discussed. The quast for gamme of the deep eerth's Interfor continues.—PMB 3

Energy Policy: A Federal Decision

The policiaa lor developmant of the netion's energy naeds for the remeindar of thia century ere being lormulated at the highest levels. The Reegan administration hes steted consistently that 'energy goals' of the kind Carter proposed for soler powar (20% of the nellon's anergy was to be eupplied by renewable recources by the year 2000) will not be ast, par ee. Tha role of merket forcas in setting enargy demend end the pace of development and aupply will be emphasized. The recent National Energy Policy Plan released by the Raagan adminieration is e comprehenalve atatemant of how the ladarel government will reetructure ite efforta to acive lhe energy problem il would eppeer that lossil luele will be the melnetey. Federal decontrol end deregulation will be in support of the forces of the merket plece. Nucleer energy will gein impetus by the dereguletion efforts.

Al the 'reneweble' end of the epectrum, the federal govemment le not expected to provide lerge funding aupport for eolar power. Perheps the lergest remeining question is how, end II, the government will support eynthetic fuele development. The production of fluids for energy from traeted coal end chele oil stocks in the nacr future will be greatly Inlluenced by en Impending decision on the emount of lederal aupport of the Syntuela Corporetion.

Fossii Fueis

Over the next two decades the domestic production of oil la expected to remein level, or it mey decline et e rele amelier than it would have without price decontrol. Naturel gas production is expected to increese effer price decontroi, now scheduled to be completed by 1985. Coel is to be the mejor (uel, domestic use la expected to double over the next two decades. Changes in the regulations on its mining and burning are expected to be a major influence in its increased use

A cruciel factor in the domestic production of petroleum mey be the exploretion of outer reaches of the continental ahell, onto the continental elopee. Little information le evalleble on how the budget for the Ocean Mergin Drilling Program is fareing. What hee been made public is the Interior

Dopartment's dosire to sett rights for oil end ges elong the enliro ouler continentat ahelt regions, an erea lotating over

Nuclear Energy

A lum toward the development of increases in nuclear energy. In the form of more nuclear-powerest generators. end in support of basic research in nuclear fusion--et the expanse of other types of energy research—has become avidant in numarous government elatements. Recently at the Senato confirmation hearings for the eclence edvisor post to the president, the nominee, George A. Keyworth, now confirmad, alated that e more tevoreble circumstence for nuclear energy should develop from the Reagen admin-

Depertment of Energy research lunds ere to be stated tor basic reaearch projects rather then for development projects. acts that con ba done by industry.

The development of synthetic fluids—liquids and goses from coal and shale oil is tricky and is inliuenced by oil pricas. No matter what the increase in oil prices, the breakeven point for aconomic synfuel development has been efusive. The obvious visw that projected break-even points were never realistic is not widoly held however. Oil pilce increases have tired initiation; thus the coale of plant development and construction, and the costs of obtaining the neceesary capital, have infleted also. The current belief is that syntuol dovelopment needs a boost from industry and the fodoraf government to obtain a tonthold in the energy mnrket. Once there, it is thought that syntucts will be competilivo. Post lears that continued government backing would ollow synthotic luois to undersoit oil are not currently voiced among polroleum companies.

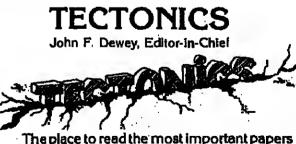
Recently, several petroloum companies—Shelt, Exxon. Conoco, end Cities Service—were reported to be among the chiol proponents of synluols for the future (Chemical and Engineering Nervs, July 27, 1981). Continuation of the unsettled international political climate through this decade could make synfuels a likely commodity, but not without a rather helty input of capital. Right now, the government Oftico of Management and Budget (OMB) is opposed to direct eld for synthotic fuols development. At stake are tean guaranloas of saveral billion dollars and lodoral price supports of synthotic tuols. Changes of the regulatory procedures of coal mining, of oil shale waste distribution, and of environmental concorne could be important factors.—PMB 4

Consolidation at U. Wash.

The University of Washington Board of Regonts has astablished e College of Ocean and Fishery Sciancas Tha new collega, officially oponing on September 1, will comprisa the School of Oceanography, the School of Fisheries. tha Institute for Merine Studies, the Applied Physics Laboratory, and the Weshington Sea Grant Program. The board atao eppointed D. James Baker, Jr., as ecting dean of the collage. He has been chairman of the university's oceanography department since 1979.

The Board of Regents elso eppointed three directors for the cottege. Donald E. Beven, appointed director of the School of Fisheries end acting associete college dean, is en adjunct prolessor of manne studies; he hed been dean of the College of Fisheries since 1980 end has been a feculty member since 1959. George C. Anderson, eppointed ecling director of the School of Oceanography, is e proteesor of oceenogrephy, he hed been essociate chairman for research in the oceanography department since 1977 and has bean e feculty member since 1958. Werren S. Wooster, appointed director of the institute for Merine Studies, is protessor of fisheries end marine etudies end en edjunct protessor of oceanography; he has been a faculty member since 1976, end the institute'e ecting director since 1979.

Stanley R. Murphy continuee es director of the Applied Physics Laboratory (APL); Williem R. Devis is ecting director of the Washington Sea Grent Progrem end continues to aerve ee associale director of APL.-BTR &



in analytical, synthetic, and integrative tectonics. Designed to bring you timely information at the lowest possible cost.

TECTONICS is a scholastically superior Journal essential to the earth scientist.

Published bimonthly beginning February, 1982

Subscription \$20.00

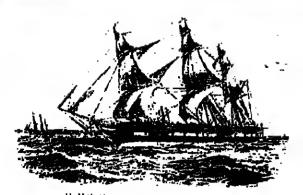
Students \$ 1,0,00

A simple ordering method is provided on member dues notices.

All others contact: SAmerican Geophysical Union 2000 Florida Ave., N.W. Washington, D.C. 20009

(202) 462-6903 800-424-2488 Washington, D.C. area Toll Free

The Oceanography Report



H.M.S. CHARLESGOR CAMER SAR, 1854.

The Oceanography Report

The local point for physical, chemical, geological, and biological poeanographers.

Associate Editor: Amold L. Gordon, Loment-Deherty Geological Observatory, Pallsades, New York, 10984 (telephone 914/359-2900, ext. 325)

Marine Science and the Law of the Sea

Introduction

Articlos ebout the Law of the Saa Conterence and its implications are certainly not among the most popular literature for marine scientists. Unfortunately, however, this conterence and the Draft Convention it is now considering may have more impact on marine science than any of our recant discoveries and hypotheses.

The present law of the saa negotialions (more correctly called the Third United Nations Contarance on the Law of the Sea or UNCLOS III) officietly started in 1973. Over 150 countries are involved in what the easily the most complex series of negotiations ever conducted. Among the important issues are freedom of navigation for military and commercial vassels, environmentel protection, resource accass and control, and many isgal aspects as well as procedures governing marina science in about 40 percant of the ocsan. How these meatings avolved, pros and cons of the major issues, and negotiating techniques are discussed elsewhere [see, for exempla, Darman, 1979; Kronmiller, 1979; Breaux, 1979. Aldrich, 1980; Richardson, 1980].

A recent development is that the Raagan administration hes decided to review all aspects of the Dratt Convention to see how it affects various U.S. Intereets. This revise comes all a lime when many countries thought that negoliations were almost complete and that only minor points remamed for discussion. Regardless of how one feels about a treaty it is fatr to say that some aspects, such as deepsea mining (i.a., nodulas) are not too favorabla to U.S. interests. Indeed, meny would argue that the present Draft Convention has enough flaws in it to pravant its passege by the U.S. Senets. It is very possible that the United Statas mey try for improvamants on soma issuea, which in lurn could yield benetits or riake to marina sclanca. II should be appreciated that few countries place the sema value on the freedom of marine sciance rasearch as does tha United States. Countries that have tried to project thie freedom includa primarily the United States, the U.S.S.R. (until 1978), tha Federal Republic of Germany, and The Netherlands, with occasionel support from Japan [Miles, 1981). Only the United Statas and the U.S.S.R. have active ocean-wids rasearch programs, whereas other davaloped countries usually have regionally based afforts. Before pro-

ceeding turthar, soma background is appropriate.

Manna scianca prior to UNCLOS III was governed by the regulations astablished in the First Conference on the Law of the Ses, which was held in 1958; this was the first time that marins scientific research was stelled in international taw. One of the lour conventions that resulted from the 1958 Conference—the Convention on the Continental

'tha consant of the coasial Stata shall be obtained in respect of any research concerning the continental shall. Nevertheless, the coastal State shall not normally withhold its consont if the request is submitted by a qualified institution with a view to purely scientific research into the physical or biological cheracteristics of the continental shelf, subject to the provise that the coastal Stole shell have the right, if it so desires, to peritcipate or to be represented in the research, and that in any event the results shell be published.'

Even this ralativaly unrostrictive sletament evantually caused some problems for merino research [Kildow, 1973; Cheek, 1973; Ocean Policy Committee, 1977]. Wooster [1981] recently survoyed the academic, Navy, and NOAA ship operators concerning difficulties for marina research in loreign waters during the 1972-1976 period. He lound that in over one fourth of the requasts (total of 407), access was deniad or inordinately delayed. Prior to and following the first conference and a second one hold in 1960, some countries expanded their territorial cleims seawerd usually elso including some control over scientific research. These extended claims, somalimes reaching out to 200 nautical miles, end the enticipation of new marine resources were among the fectors leading to UNCLOS III.

UNCLOS III negotiellons have produced saveret iteretions of e potentiel traaty. The most recent one, referred to
ee the Draft Convention on the Law of the Sea, has been
treated as being close to, if not elmost, the final document,
Although small revisions have been made over the years to
the merine scientific research articles, the basic conditions

for research in the tsrrilorial ssa, the axclusive aconomic zone (EEZ), and the remaining regions of the ocean are tatrly clear. Some argus that the conditions are straidly part of international lew. The new regime for the ocean will, without a doubl, change the way in which marine scientists and marine scientific research operate. The Draft Convention will restrict many scilvities of U.S. marine scientists, but it may also offer certain opportunities.

An Important point in assaying the impact of UNCLOS Iti on marine sciance is whether science would be better served without e tresty. It is easy to conclude, however, that sithough the Draft Convantion is not vary good for marine science, it is, because of other svants, better then no iresty. The reason for this apparently contradictory statsment is that as of Fabruary 1981, 88 coastal states have alraady declared some kind of s 200 nautical mils zone out ot e total of 135 cosatsl atatas. In eddition, 69 of thess states either apscitically or indirectly claim jurisdiction over msrine research in their 200 mile zone [M. H. Katsouros, pereonal communication, 1981]. With the damise or absence of e treaty, it seems reasonable that the remaining countries will also adopt at laast a 200-mile zone. It is also reasoneble to assume that the conditions for marina scienlitic reeearch, without a treety, will be et leest as reetrictive as those in the prasent Draft Convention. These rules would probably differ from country to country end will present e potentiel administrativa quagmire for the U.S. Depsriment of Stats and, thus, also for the U.S. merina scienliste end administrators who will need the State Department lor informetion end permission to do resaerch. Another point is that continuing extension of states' claims farther into the ocean end additional rules for marine aciance are less likaly onca s treaty is in placs than without one since a treaty will define and limit most jurisdiction.

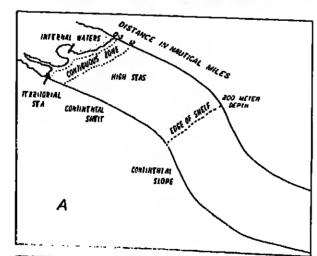
The general review of the Draft Convention initiated by the Reagan Administration could have an impact on marine scientific research. If the United States decides to withdraw from further nagotiations, it is hard to imagine that the sciance articles could be improved (since the Unitsd Statea is the principls country concernad with marine science in a positive sense), and indesd they could gat worse. It ths irsely negotiations wers to tell because of the United Stales' withdrawel, scientific research could suffar if countries attampted retribution against the United States for its psrcsived role in spoiling the contsrenca. If the United Stales continues in the conterance but puts its emphasis in obteining beltar conditions for deep-sea mining, some scientific banelits could be negotiated sway. Another possibilily is that the United States, in its ravisw, decides that improvemants in the merine scientific research enticles are important and, in some mannar, successfully negotiates im-

The Law of the Ssa nsgotiations eatablish severel new zonas in the ocssn and redefine some old onss (Figure 1) within each there are conditions for marina scientific research. The principle zones for merine sciences ere internal water, territorial ees, straits, erchipslagos, exclusiva economic zone (EEZ), continental shall beyond 200 miles, and the third that the third that the continent is the second that the continent is the continent in the continent in the continent is the continent in the continent in the continent is the continent in the continent in the continent is the continent in the continent in the continent is the continent in the contin

Specific Regions

Intarnal Weters

Coastel stalas, under the Drsft Convention, heve complete eoversignty over activities within thair internal waters. Thase waters include rivere, beys, lakes, end other areas on the landward side of the basslins from which the terri-



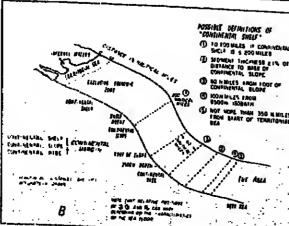


Fig. 1. A comparison of the major divisions of the coesn (a) under the 1958 Geneva Convention and (b) under the Draft Convention (see text for further details).

torisl saa is delinaated. There are only slight changes from the 1958 Convention on the Tarritoriel Ses and Contiguous Zone, mainly in the methods by which the baseline is megsured.

Territorial Sea

The Draft Convantion establishes a territorial sea, 12 nsutical miles wide, a point that essentially is now an estsblished principle in international isw. This, ironically, code sclusly be an adventage to some scientific work. The U.S. State Dapartment, at prasent, recognizes only a 3 milewids tarritorial sea; thus, e U.S. ressercher has e problem If his or she wents to work, say, 100 milea off e country the hes declared a 200-mile tarritorial sea. In this tairly common eltuetion, the U.S. Steta Department generally would not make the permission request, since to do so would be a tacit acceptance of thet country's claim. Alternatives for ressercher are to request permission to work within 3 miles of the coast (in which cese the U.S. Stete Dspartment could ask for parmiselon) end ectually to conduct the research there (and et 100 miles) et an incressed cost lo the project or to svoid the problem end work outsids of 200 miles. With an internetionally accepted 12-mile territorial sea and the protection efforded to the coasisi state by the EEZ (see next section), some of the diplomatic problems essocieted with various territorial sea claims should be elimineted. This is not a email point, aince, as of Msy 1981. 80 statee claim a 12-mile tarritoriel sea, 25 claim more than 12 miles (14 of these cleim 200 miles), and only 28 states cleim leea then 12 miles (Office of the Geogrepher, U.S. Department of Stete). The Dreft Convention, if accepted. should aliminate cleims of more than 12 miles for a territor-

Within the tarritoriel sea the cosstal stats has the sactualive right to regulate, authorize and conduct marine scientific research, . . . [which] shall be conducted only with the express consent of and under the conditions set forth by the coastal Stata' (Article 245).

Although coaetel aletes heva soveraignly over the territorial eea, there is e right of innocent passage. However, "the carrying out of reaeerch or survey activities" is sliminaled as an accepted activity under innocent passage. Thus the control over marine scientific activities in a well-defined territorial sea era cleer. However, no statements are made concerning the mechanisms necessary to get permission or the conditions that e coastal stete can impose on a researching state or institution if they want to work in a country's territorial sea. Presumably, such arrangements would be made on an ad hoc basia.

Stratte

The Internetional acceptance of a 12-mile-wide territorial sse will affect many previously international straits. One hundrad and sixteen strelta ere more than 6 but isss than 24 miles wids end would now be included within the tenttorial aeaa of the edjecent atetes [U.S. Stete Department, 1974]. Article 40 in the Draft Convention eays that foreign shipa, including marine scientific research and hydrographs aurvey ehips, may not carry out eny research or survey activitise without prior authorizetion of the States bordsring etralta.' This restriction could make it vary difficult to conduct research in euch atreits, in pert beceuse usually two or more atates will have to give permission. Straits between major bodias of weter (Beb el Mandeb or Gibreller, lor example) are obviously important end interesting cress for atudy. A further complication concerning strait researchis the absence of etetaments concarning the mechanisms lot getting permission to do rasaarch end tha restrictions of conditione thet e coastal eteta can place on the research implied consent, which exists in the EEZ, does not extend to rasaerch in etraita where the unclear conditions and mechanisms of the territorial age epply.

Archipalago

A sarias of erticlee in the Dreft Convention will permit is land at lete to define basslinee for erchipelsgic welsa. The ectuel extent of these waters le not cleer, end definition probably awelts jurisdiction. What le clear is that the island state will have tarritorial east rights over its archipelsgic waters for scientific research.

Exclusive Economic Zone

The exclusive economic zona or EEZ is ensw concept end preeante e major problem for marine acisnoe, it extends 200 neutical miles (370 km) from the baseline from which the tarritorial sae is measured (Figure 1b). Thus, it includes ell the coestel waters of the world and moet of the continentel shelves (in the gaological aense). It encloses (with the territorial eae) about 32% of the ocean (Figure 2) Prior to UNCLOS III much of this area was open to many forms of mertne scientific research. The conditions for the aciantific research in enother country's EEZ are consent with numerous requirements. The important aspects are as follows:

1. Consent le necessery and 'enall in normel' circulte stancee be granted (Article 248, part 2). It can be denied tha project (a) 'le of direct eignificance for the exploration and axploitetion of neturel resources, whether living or not living; (b) Involves drilling into the continantal enelt, the use of explosives or the introduction of harmful substances into marine anvironment; (c) involves the construction of atton or use of errificial islands. (d) contains insculling information or it the researching State or competent international organization has outstanding obligations to the

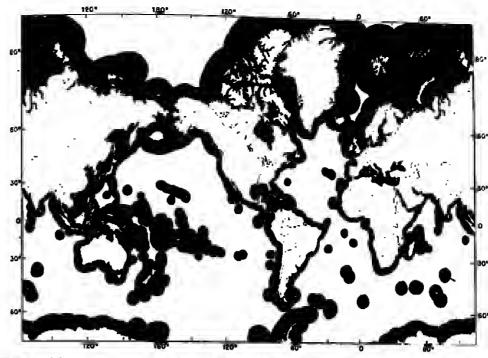


Fig. 2. The area of the ocean covered by a 200-nautical mile Exclusive Economic Zone (EEZ). Note that this is a Marcelor projection and that the size of the polar regions to exaggerated [from Ross, 1980].

part 5). A coestal stata's decision bessd on the above provisions is not reviswable by a third party.

2. Specific informetion must be supplied not less than 8 months before the stert of the project. This includes (a) 'the nature and objectives of the project; (b) the method and means to be used, including nerne, tonnage, type and class of vessels and a description of scientific equipment; (c) the precise geographical erees in which the project is to be conducted; (d) the expected data of first appearance and final departure of the research vessels, or deployment of the squipment and its removel, as appropriate; (e) the name of the sponsoring institution, its director, and the person in charge of the project and (f) the extent to which it is considered that the coestal State should be able to participate of to be represented in the project (Article 248).

3. Specific conditions must be met. Applicants asking for consent to conduct research must (e) 'ansure the right of the coastal State, if it so desires, to participate or be represented in the marine scientific research project, especially on board research vessels . . . '; (b) provide preliminary and final reports; (c) provide access for the coastal State to all date and samples from the project and 'furnish il with date which may be copied and eemples which may be divided without detriment to their scientific value; (d) provide, il requested, 'an assessment of such date, samples and research results or provide assistance in their assessment or integralstion; (e) ansura 'that research results are made integralstionstly available through appropriate national or integralstionst channels; (f) 'Inform the coastal State Immedialely of any major change in the research programma' (Article 249).

4. 'Communications concerning the marine scientific research projects shell be made through appropriate officiel channels unless otherwise egraed' (Article 250). Thass channels probably are foreign ministries and the U.S. Depariment of State which surally will lessen the role of scientific scientist resistances.

cassiul in developing projects.
5. Coastal sistae cen suspend research activities it (e) it is not being conducted in eccordence with the information communicated (i.e., informetton requested in Article 248) or if the conditions specified in Article 249 ere not mat; (b) there is a major change in the reseerch project or ectivities (Article 253).

6. After permission to conduct research is grented, land-kicked and gaographically disadvantaged Statas in the ragin mey request to receive the information provided under points 2 and 3, above. These etates may also perticipate, when lessible, in the project through quelified experts, although the coastst state can object to the choice of expert. Notwithstanding the foregoing conditions, consent is implied, and the researching steta or organization may begin assert 6 months after submitting its request if the coastst state has not defined consent within 4 months efter receiving his information epacified in Articiae 248 and 249. However, the coastst state can esk for edditional information and posipone, almost indefinitely if it desires, a decision. Therein lies one of the biggest problems of the Draft Convention; the leck of predictability concerning a cruise.

Conlinental Shalf Beyond 200 Miles

The continental absit in the Dreft Convention has a complex delinition (see Figura 1b) that extends it to a distance of 200 nautical miles (i.e., coteminous with the EEZ), if the continented margin (sheff, elope, end rise) dose not extand to 200 neuticst miles. If the continentel mergin extends be-Yord 200 neuticsi mitaa, saveral definitions coma into pley based on the thickness of the aedimentery rocks (how this hickness is determined is not aleted) or distence from shore, but, in any case the limits of the continental shelf shall not axceed 350 nautical miles from the territorial eae baseline or 100 neutical miles from the 2,500 m isobeth. The exect areal extent of this region cennot be datermined at this time, but it is thought to be about 6-8% of the ocean. The provision concerning sadiment thickness for da-TRANSION Cartainly will parmit confusion and allow for ex-Cassivs cleims.

All the marine scientific conditions manifoned above for the exclusive economic zone elso apply to the Continantal shall except that a coestal state may withhold consent only in specific areas that it has publicly designed as subject to exploitation or detelled exploratory operations within a reasonable period of time. In addition, research in the weter column beyond the limits of the EEZ is permitted.

The Area

The region outside of cosstat stets jurisdiction is defined in the Drait Convention as the Aree (i.e., the remaining 80% or so of the ocean). Basically, there are no significant restrictions in the Draft Convention concerning marine sciantific research in the Area. However, there is a provision for a review conference to be held 15 years after commencement of commercial production of mineral issources (nodules) from the Aree that could have the potential for mischief. A suspicious mind could imagine treadon of marrine sciantific research being regarded as a negoliating chip that might be surrendered by the United States or other developed countries in return for assured and continuing access to ocean minerals. If ocean thermal energy conversion (OTEC) is lound to be a successful source of energy, regulations concerning the water column could also be developed.

The Draft Convention does say that 'states and competent international organizations shall promote and lacilitate the development and conduct of merine scientilic research in accordance with this Convention' (Article 239) and that coasts states should 'endeavour to adopt reasonable rules, regulations and procedures to promote and iscilliate marine scientific research . . . beyond their territorial sea and to lacilitate . . . access to their herbours and promote assistance for marine scientific research vessels' (Article 255) Atthough these statements are veluable, they are not binding

Publication Problems

A major gensrsl concern for science in the Drsit Convention is publication righta and the flow of scientific data. Articls 249, paragraph 2, requires 'prior agreement for making Internationally available the research results of a project of direct significance for the exploration and exploitation of natural resources.' This is a confusing statement since Articls 246, paragreph 5s, ellows coasts slates to withhold psimission for research in their EEZ or on their continental shalf beyond 200 miles if the project is 'of direct signiticanca for the exploration and exploitation of natural resourcee, whether living or non-living.' A difficulty for open publication is that elmost any type of marine ressarch could have some relevance to resources, and such an interpretation during or efter the work could effect publication rights. It should also be repaated that the coastal State has compiste discration to determina whet ressarch is of direct significance for resources, and thus it is possible for a coastal steta to dany consent for almost eny typa ot marina reesarch. This is e major change from the 1958 convention where open research was ancouraged.

Implications and Recommendations

The above conditions clasrly indicats the nsed for changea by U.S. menne scientists, institutions, and funding organizations in their manner of opsration. Meny of the arilcles mentioned shova have pitfalla, and ciserly any lorsign country that wishes to refues or delay e project should have no trouble finding e justification. Alternatively, if a country supports the research, tha detailed requirements mey become marely administretive taske, except probably for foreign psriidpetion in research and shering of deta. Thass letter two items and othere could involve additionel costs beyond that of the initial project. As a coestal elete can deny a rasearch requast from a country il there are. outstending obligetions ageinst a previous project by that country, how end when e research project ends should be clearly defined in early negotiations. The praviously meniloned problams for publication is importent and ahould also bs reconciled in seriy stages of negotiation. The point that research activities can be suppended if there is e major (undafined) change in the project also posse potential difficultise. Changes can occur owing to ship breakdown, loss of squipment, weather problems, or adjustment of cruisa tract or objectives in accordance with sciantific information gained during the cruiss. A coastal state will, undar tha Draft Convention, heve the spillity to effect or stop a project in almost any phasa of ite activity.

Once (or if) the Draft Convention is opened for relification than inight well be a transition period of several years before it is approved. During this period tha U.S. Stata Department might either follow the present U.S. position on various issues (auch as the 3-mile territorial see) or the

Draft Convention. Either situation could prasent potential for confusion, unnacessary delays, rejections, or evoidance of research requests. (Similar and parhaps more complex problems are possible if the United States withdraws from

the treaty negotiations or if a treaty falls.) Two Indirectly related aspects may cause a reduction in U.S. marina science offerts within lorolgn EEZs. The first Is that scientists end institutions just may avoid working in certain areas beceuse of anticipated or past difficulties in conducting research there. This may already be seen in tho gensral avoldance of waters of Trinidad and Tobago, India, and the Soviet continantal shalf. By such evoidance, we can make the problems of the Dreft Convention come Irue without even trying. Sacond, our own government mey require e strictsr scherance to the Draft Convantion than individual countries might impose. In addition, having to deal through official channels could discoured many individual scientiets. As marine scientists wa should be prepared and willing to lest end, it necassary, evan challanga strict or arbitrary interpratetions to sae if we can work out agraeeble errengements, such es bileterals [see Open Policy Committea, 1981) rather than letting activities overtaka us.

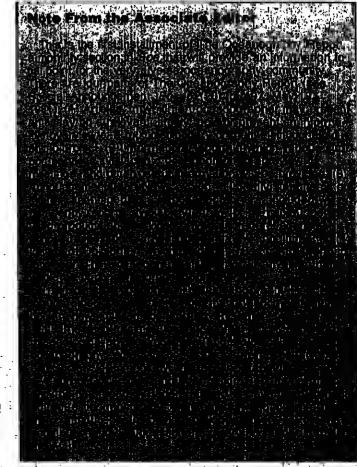
For U.S. marine scianca and marine sciantists to continua their tuture research activities in the world oceen certsinly will imply additional administrativa and lunding consideratione. Perhaps most importent is that the development of foraign programs will require mora tima and imposs additional costs. The necessity of heving at foest a 8-month ised time to get permission has implications for grant approval by organizatione like the National Science Foundation and the Office of Navel Rasearch, which tand to operate on a 1- or 2-year linearcial calendar.

Concern and opportunities should be astablished for preliminary meetings betwean U.S. and foraign scientists and administrators for the davalopment of joint programs as wall as to increased support for U.S. scientists to participate in international meetings such as the intergovernmental Oceanographic Commission (IOC). Perhaps a separata funding source should be astablished and used to explore and discuss possibilities for foreign programs. The importance of participating in international organizations like tha IOC stems from Article 247 of the Draft Convention, which provides a machanism by which such organizations can get consent for projects in the waters of member states.

Funding organizations and rosearch Institutions will have to be aware of the conditions on marine research under the new ocean regimo and recognize that training of foreign scientists, data evaluation, and the like will be common components of rosearch projects. Sciontists, especially young ones, should not be penalized by participating in such activities even though it will divert them from their prime sciontilic objectives. Large or active institutions should consider the establishment of a foreign office that can help their scientists, administrators, and the funding agencies in developing and keeping track of toreign activities. It would be naive to think that the everege scientist could wander through the potential maze of regulations imposed by the Draft Convention without any help and come out many years later with an administratively, scientifically, legally, and internationally setIslactory program, end ba willing to try it again. On the other hand, the U.S. State Department, funding agencies, institutions, end individual scientists should be eble to survive and aven thrive in this new regime it wa work together.

Acknowledgments

Many of the thoughts expressed in this note have evolved from discussions with my colleagues on the Freedom of Ocean Science Task Group of the Ocean Policy Committee of the National Academy of Science. In particular, I would like to acknowledge William T. Burke, John V. Byrne, John P. Crevan, Paul M. Fye, Mary Hope Katsouros, John A. Kneuss, Edward L. Milas, Roger Revelle, Mentk Talwani, and Warren S. Wooster but am not implying that they agree with everything I have eaid. Support for writing this nots has come from the Department of Commerce, NOAA, Office of Sea Grant under grant NA80AA-D-00077 and the Paw Mamonsi Trual.



References

Aldrich, G. H., Lsw ol Iho Soa, Dop. ol Stele Buil., Current Policy

Bresux, J. B., The diminishing prospects for an acceptable law of the ses treety, Virginia J. Int. Law, 19, 257-297, 1979. Check, C. H., Lew of the see: Effects of verying cossial sinto controis un merine rosearch, Ocean Dov. Int. Law J., 209-219,

Summor, 1973. Oermon, R. G., The lew of the see: Rethinking U.S. Inferests, Forolgn Affeirs, 57, 373-395, 1979.

Kildow, J. A. T., Neture of the present restrictions no occuric research, in Freedom of Ocean Research, odiled by W. S. Wooster, pp. 5-28, Crene, Ruessk, New York, 1973. Kronmiller, T. G., The Lewiulness of Oeep Sesbed Mining, XIV.

Dep. of Commerce, U.S. Government Printing Office, Weshing-Miles, E., The tuturo of U.S. distent-water oceanography in the

new ocsen regime, in Proceedings of the Symposium, Future of Oceanography, Springer-Verleg, New York, in press, 1981. Oceen Policy Commillee, The marine scientific issue in the Lew of the See nogotistions, Science, 197, 230-233, 1977.

Oceen Policy Committee, Biteterel Agreements for Morine Science, National Acadomy Press, Woshington, D. C., 1991. Richardson, E. L., Power, mobility and the law of the sea. Foreign Affairs, 58, 14) 902-919, 1980.

Ross, O. A., Opportunities and Uses of the Ocean, Springer-Varleg, New York, 1980.

U.S. Stale Oppartment, World Strelts Affected by o 12 Mile Terri-Ioriel See, Dep. of Stete Bull. 70, 1974.

Woosler, W. S., Ocean research under lereign jurisdiction, Science, 212, 754-755, 1991.

David A. Ross is a Senior Scientist in the Geology and Geophysics Department of the Woods Hole Oceanographic Institution, Woods Hole, Maasachusetts.

Opinion



Figure 2 of Ross' article, 'Martne Science and the Law of the Sea, is the convantionel illustration of the Exclusive Economic Zone that would be established by a 200 mile limit. A more realistic view of the impact is obtained by plotling the 200-mile limit on en equal area projection. The above map is an oblique Hammar equal-area projection with interruptions such that the world ocean is shown as a unil. (Figure from Alhelslan Spilhaus, Middleburg, Virginia.)

Information Reports

Speciel Sessions Headline Fail Maating

Two special sessions have been added to the oceanography roster for AGU's Fall Meeting, bringing the total of special oceanography sassions to 14, according to Barbara Hickey, Fall Maeting program chairman for oceanogrephy.

The Fall Meeling will be hald in San Francisco from December 7 to 11; the deadline for abstracts is September 16. Details for submission of abstracts were published in the June 30 issue of Eos.

A session on MARSEN (Marina Remote Sensing Experint) is one of the new additions to the meeting. MAR SEN, an internetional collaborativa exparimont, was conducted in the North Sea between August and November 1979, reports Omar Shemdin at the Jet Propulsion Laboratory (JPL). The experiment explored the application of ramole sensing techniques to delact surface wavae, wind. current, and surface expression of oceanic fronte, and to undarstand better dapth-limited oceanic processes. For edditional Information, contact Omer Shemdin at JPL. Mail Slop 183 501, 4800 Oak Grova Drive, Pasadena, CA 91 t 03 (totephona: 213-354-2447).

The second new session will raview the POLYMODE Local Dynamics Expariment, which was designed to observe mesoscale eddy processes in the southern part of the Guif Stream Recirculation region. The progrem included velocily, tempereture, selinity, and oxygan profiling, current metar moorings, and SOFAR floats. Most of the material in the session has nevar been presented to e broad audiance. Included on the egenda ere principal descriptive results of the experiment and preliminery dynamical interpretation of the mesoscale processes that occurred during the experiment. Additional information can be obtained from Bruce Taft. PMEL-NOAA, 3711 15th Avenue, N.E., Seettle, WA

98105 (telephone; 206-543-7129). An AGU aession on Marginal Ice Zone (MIZ) Processes also la on the agenda for the Fall Meeting. The session is particularly appropriate at this time, notes conteol Robin Muench of SAI/Northwast, because a major international

program (the Marginal Ice Zone Expariment, or MIZEX) is In the final planning stages; field activities are echeduled to commance in 1963. The sassion will provide an excellent torum for updating and eynthasizing results from the incraasingly active MIZ-related progreme. In addition, tha session will provide valuable input tor MIZEX. Sassion lopics will includa oceanic, atmospharic, and saa-ica processes that raista to the MIZ and regional aspacts of the rasults. An invited overview presentation will be made by Ola Johannassan of the University of Bargen, Norway. Saeiye Martin of the University of Washington in Saatile will present a contributed talk on the formation of ica factore along the MIZ. For additional information, call Robin

Muanch, the session chairman, at 206-747-7152. A aassion on HEBBLE (High-Energy Banthic Boundary Layer Experiment) also will highlight the maeting. HEBBLE is an integrated, multidisciplinary deep ocean program funded by the Office of Naval Research. The scientific goal of this affort, according to Charles Hollister at Woode Hole Oceanographic institution and project director, is to quantity tha magnitude of deep-ocean currents and their tamporal and spatial variability end to predict the response of the cohesive, biologically altered sadiment to the impossd stressas. The long-tarm goal is to formulate and flaid-varify a predictive sadimant-transport model for cohasive material in high-energy areas. The session is timely, according to Hollister, bacause II tollows a very exciting 1981 flaid sassion In the North Atlantic. For additional information, contact Charlas Holliatar at WHOI, Woods Hola, MA 02543 (Ialephone: 617-548-1400, ext. 2200).

Papare to be presented at the MANOP (Manganesa Nodule Project) session will preaant some of the most recant work done in the project, which studies the processes that control the distribution and composition of deep-sea torromanganesa nodules. Through a series of integrated expariments, MANOP is attampting to identify the sources and tluxes of transition metals to the sediment-water interface. MANOP is also altempting to resolve the partitioning ot the elements between particulate debris, bottom and pore waters, and nodula and sadiment phaeas at a small number of 'type' Pacific deap-saa environmants. For addilional informetion, contact Jack Dymon at the Oregon State University, Corvallis, OR 97331 (talephone: 503-754-2296), or Paul Dauphin, University of Rhode Island, Kingston, Ri 02681 (lelephone: 401-792-6127).

Other special sessions and their contacts (and telephone numbers) are listed balow.

West Coast Circulation: Bob Baardsley (617-546-1400, axt. 2536); Veme Channel: Hydrography. Geochemistry. end Sediment Dynemics: Pierre Biscaye (914-359-2900) or Dava Johnson (6t 7-548-t 400, ext. 2463): Hewaii-Tehiti Shuttle Experiment end Mid-Lelitude Large-Scale Variebility: Dava Culchin (714-452-3226); Dynemics of Coasial Circulation Over Topographic Feetures: Phil Hsueh (904-644-2525); Coastel Oceanography and Paleo-oceanography: Barbara Hickey (206-543-4737); Estuerine Processes— Physicel, Chemical, and Biological: Dave Patarson (415-323-6111); SANDS (Shalf and Nearshore Dynamice of Sedimentelion): Chuck Niltrouer (919-737-3711); Southern Ocean Studies: Worth Nowlin, Jr. (713-645-2647).—BTR

Ocean Drilling Raorganized

The National Science Foundation has combined its proposed Ocean Margin Drilling Program (OMPD) with the existing Deep-Sea Drilling Program (DSDP). This reorganizalion catle for the retirement in 1963 of DSDP's mainelay, the Glomar Challenger, which ie naaring its 14th year of operation. The Glomar Explorer, tha tormer CIA ship, with 6 times tha carrying capacity of the Chellenger, will become the sole NSF drilling ship.

Engineering and science planning for OMDP will continus largely unchanged with the new plan, though the echedules for achiaving aome scientific objectives may change, according to the Joint Oceanographic Institutions, Inc. (JOI), a consortium of 10 acadamic oceanographic institutions. Additional Industry and foreign support will be sought

Reaction from the academic community has been posilive. Response from the petroleum industry, which shares with NSF the cost of OMDP, le mixed, but understandably so; the reorganization will delay by eaveral yeare drilling along the passive ocean margina that could lead to the discovery of oil and gas depoalts.

Although the details of the pla mered out, the first phase of the Explorer's conversion is expected to begin in fiscal t 983 and to continue into fiscal t684. Launch of the newly outfitted Explorer is anticipated in middla-io-late 1964, according to Allan M. Shinn, Jr., diractor of the new Office of Scientific Ocean Drilling; tha office was creeled by NSF Director John Slaughtar in aarly August to smooth the merger transition. Shinn, formerly senior science associate to Slaughtar, noted that there will be no drilling for 8 months to 1 year.

Returblahmeni of the Explorer, now mothballed in Sulson Bay (north of San Francisco, Calif.), will give the ship drilling capebilities similar to those of the Challenger. Two to three years latar, the Explorer will go back to the yard for a second conversion to add riser and well-control technologlas, which make possible drilling on the passive ocean margine by controlling the pressuree ancountered it the drill accidantaly strikes hydrocarbon deposite.

Changaa in the drilling progrem were epurred by a lack of conaansue on the scientific objectives for ocean drilling, Shinn told Eos. The Explorer, whan it is ready, will allow the scientific community to set goals without the physical constraints of the working drill plafform, he explained. Additional Impetus came from the tightening of the tederal moneybelf. It's clear that NSF can't consider operating 2 ships. said Shinn. Diperetion costs for the Challenger are about \$25 million (1981 dollars) per year; when the Explorer goes into operation, its costs would equal about \$40 million (also 1981 dollars), excluding phabilitation costs.

Shinn raports that the academic community's response has been positive. in addition, the executive committee of the Joint Oceanographic Institutions for Deep Earth Sanpling (JOIDES), an international organization of advisory panels and committees, mal in Germeny the week of Apgust 10 and unanimously agreed that putting the two programs together was a good idas. Informal responses from foreign nations also have been optimistic. Shinn said

Patroleum industrias, though, ara mora refucient lo give the plan haarly approval. The 10 oil companies that agree last year to match funds with NSF to finance OMPD first heard about the reorganization at a July 22 meeting with John Slaughter in Houeton, J. B. Coffman, vice president for exploration at the Exxon Production Research Co. stressed that Exxon has not complated its snalyels nor adopted an official position on the new plan. He did say, howavar, that ha thought it was good for the governments program direction to have one research vessel. Even so, Coffman is unsure of the cost effectiveness of the program Fewar holee will be drillad with the risar technology, and, elthough this will reduce tha bottom-lina cost, the cost par well drilled will be higher in the new plan when the conversion costs for the Explorer are considered, he told Eos.

Tan other patroleum companies were invited to pericipate in the ocean drilling program, and they attended the Houston meating.

NSF expacts to supply the oit companies with a detailed conversion plan in Juna 1962, Shinn said, which will includa an Inlagrated scienca plan for the Explorer, an operation and control management plan, and detailed designs and cost estimates for the ehlp's convarsion.-BTR

Announcements

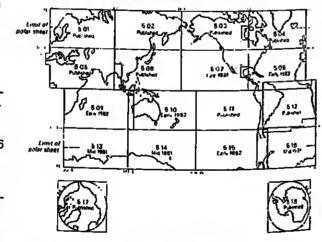
Bathymetric Charts Near Completion

The fifth adition of the 'General Bathymetric Chartol the Oceans' (GEBCO), the series of bathymatric charis that originated at the Seventh International Gaological Congress in Berlin in 1699, will be complete soon.

Thirteen of the final 18 charte that cover the world are available. The last chart should be complete next Mey. All of the charts have a scale of 1:10,000,000; polar sheets

Guiding the chart production is a joint committee of marine geologists and geophysicists from the international Hydrographic Organization and the intergovernmental Oceanographic Commiseion of UNESCO. Cartographic production of the sheets is undartaken by the Canadien Hydrographic Service in Ottawa. The basic project, grid. and land work is taken from the Carte Generale du Monde by permission of the institut Gaographique National in

Sheeta are available at \$5.00 (Canadian) plus handling charges from Hydrographic Chart Distribution Offics, Department of Fisheries and the Environment, 1675 Russel Road, P.O. Box 6060, Ottawa, Canada K1G 3H6.



NOAA Starts Oceanography Publication

A new NOAA publication entitled Oceanographic Month Summary began in January. The publication, edited by Stava Auer, replaced two other NOAA periodicals, Guitsiream and Fishing information, and it will attempt to disseminate the monthly oceanographic information in a more timely and efficient mannar than did the other two publica-

Oceanographic Monthly Summary contains 15 sea sufface temperature (SST) analysee, 3 oceanographic thems feature analyses, and a Bering Saa/North Slope Ica analyele. The SST analyses include monthly means, anomale and yearly changes for the Atlantic and Pacific oceans and tha Gulf of Mexico in both 2° and 1° latitude/longitude scales. The ocean feature an alyeas show and describe. monthly activity of the Guif Straam systam and its ed addlee for the northwest Atlantic and Gulf of Mexico. wall as other observed thermel features for the west U.S. coaet. The Bering Sea/North Slopa ice analysis scribae sea ice aga, thicknese, and covarage for the cribae sea ice aga, thicknese, and covarage in a The National Waather Service and the National E. The National Waather Service and the National E. The National Waather Service and the National E. The Nation

Satellita Service jointly sponsor the publication.

JGR on Seasat

A special leave of the Journal of Geophysical Resalt will be devoted to eolerfiffic results from Sassat in the college. plines of oceanography; meteorology, gaodey, and gaode

Born of the lentative title of your manuscript by October 1. 1981. Authors are encouraged to submit menuscripts se soon as possible but no taler than Decamber 1, 198t. Standard JGR review procedures will be followed.

Geodesy and glaciology manuscripte should be sant in guadrupilcata to Thomas J. Ahrens, Selsmological Labora-10/9 252-21, California Inslituta of Technology, Pesadena.

Manuscripts in other disciplines should be sent in quedruplicate to A. D. Kirwan, Jr., Department of Marina Science, University of South Florida, 630 First Street South. St Petereburg, FL 3370 t.

This book is a very nica alamentary description of the hy-

diography of the World Ocean (the unity of the oceans le

Reviewed by L. K. Coachman

ly, it looks as it does.

relation to other ocaans.

in addition, plessa send ona manuscript copy to George H. Born, Jet Propuleion Laboratory, M/S 264-737, 4600 Oak Grova Driva, Pssadens, CA 91109.

Meetings

Oceen Hydrodynamics Colloquium

The 14th International Colloquium on Ocaan Hydrodynamics will be hald at the University of Liage, Belgium, May 3-7, 1962. The subject will be 'Marine Hydrodynamics of

the Equatorial Ocaan,' with emphasis on theoretical ocean-

Members of the Drosnizing Committee ere Jacques Nitioul, Jens Meincko, David Anderson, Dannis W. Moore, Jemes J. O'Brien, and S. G. H. Philander. Those who with lo presant papers should contact Dannie Moore el JIMAR, University of Hawaii, Honolulu, HI 96B22, or Jacquea Nihoul at Geophysical Fluid Dynamics. University of Llega. Belgium. Nongovernment U.S. participants may contact Jan Witte at Nova University Ocaanographic Centar, 6000 North Ocean Drive, Dania, FL 33004, for possible Ireval support.

New Publications Coastal µpwelling Descriptive Regional Oceanography P. Tchemia, Pargamon Mer. Ser. vol. 3, Pergamon, New clear pictorials of pertinant features such as general circu-York, xvii + 253 pp., 1980.

Francis A. Richards, editor

The first volume in an all new series: Coastal and Estuarine Sciences

The multidisciplinary expanse, international focus, and societal relevance of this monograph will serve as the major reference in coastal upwelling for many years and remain the touchstone for scientists for future research.

Inquiries and standing orders to this series are welcome.

- Price \$23.00 Hardbound • 544 pages • Illustrated
- 20% Member Discount

Orders under SSII must be propald Monie-Cord)



🖎 American Geophysical Union 2000 Florida Ave., N.W.

Calt 800-424-2488 toll free 462-6903 in the Washington, D.C. area

Washington, D.C. 20009

istion, summer and winter surface temperatures, prevailing winds, precipitation, atc. Everywhere the author has ettempted to stay with the 'big picture,' avoiding tha tinar scalas of tamporal and spatial variability so dominant in the rasults of physical ocaanographic descriptive study of recant decades. The approach is definitely classical, in the manner of Schott, Svardrup, and Diatrich.

emphasizad). Hydrography ts uaad in its claseical sansa: the observed distributions of temperature, salinity, and dan-The book was developed from lactures at the University sly. Dietributione of other proparties are not included, of Paria for baginning atudents in a ganaral oceanography though occasionally oxygan concentration is mentioned as course. In Tcharnia's words, '... II quickly bacama apparan aid in interpratation (a.g., as a corroboration of the tima ent that the students, whathar physicists, biologists, chama water mass has been removed from the surface). There lats, or gaologists, had only the most fragmentary knowledge of the ocaans . . . '; in my words, they wera oceanoare no equations and hence no heat and salt budgets. Though current speade and transport values are given, wagaographically Illiterate. This is true of students coming into ter budgets derived from these are only implicit. The roles most ocaanographic curricula everywhare. But what treof advection and mixing in creating the hydrographic distriquently happans is the students all loo rapidly become involved in the myriad details of their spacially and naver do buttons are introduced solely in a qualitative way. In short, his book is, as the titte says, a description of World Ocean gat a teeling for the geography of the World Ocaan. Thus, I wdrography. But it is more than that. The description is inparcaive this book to be a very useful contribution to the cluded within a discussion of the ocaan basin torm and tosuite of ocaanographic textbooks. It could be used as a pripography, wind systams, climatology, end even (briefly) mary text in tha tirst course for all ocaenography majors. regardless of spacialty. If would not be the sole text, as sediment distributions. Thus, the reader can be informed some amplification is nacessary to provide e salistactory inon not only what the ocean looks tike, but why, qualitetivetroduction. For example, though TS analysis is employed in the water mass descriptions, the concepts of TS analysis The World Ocean le dascribed in four msin parts: the ara not discussed.

Southern Ocaan, tollowad by the Atlantic, Indian, and Pe-The book is well produced, the type and figures are cific in order. The description of each region tollows the clear, and the tlaxicover edition I have seems well bound. plan: (1) torm, dimensions, location; (2) topography, sadi-The translation (trom French) is excellent. Typographical ments; (3) atmospheric pressure, winds, basic climatology. errors are taw and tar batwaen, some of which derive Irom (5) hydrology-distributhe translation, but none I spotted inhibited understanding. I fon of S and T, structure and water masses, origin and torcommend this work to all those engaged in teaching tuluro mailon of water masses, movements of water messes, and oceanogrephers, to the extent of perhaps evan influencing the ordering of the subject matter in their present curricula. At the beginning are three short chapters containing ba-It will also sarva well enyone who wishes a concrse oversic concepts of the morphology of the earth and ocean ba-

view of the hydrogrephy of the World Oceen. sins, physical and chemical characteristics of seaweter, and the dietribution of T, S, and density. Throughout, most L. K. Coachman is with the Department of Oceanograpoints are illustrated by appropriate horizontal or vertical sections, charts, and graphs, and 19 separate plates are

phy, University of Washington, Seettle, Weshington.

EOS offere classified space for Poelitions fraighte, Poelitions Wanied, and Sarvices, Supplies, Courses, and Announcements. There we no discounts or commissions on classified ads. Any type that is not publisher a choice is deged for at display rates. EOS to published weekly on Tuesday. Ada musi be received in Milvig on Monday 1 waek prior to the data of the

Classified

Replies to ada with box numbers should be stressed to: Box ____, Amarican Gaophysical than 2000 Floride Avenue, N.W., Washington, CC 20009.

POSITIONS WANTED Rates per tine 1-5 limes—\$1.00, 8-11 times—\$0.75, 12-26 limes—\$0.55

POSITIONS AVAILABLE ales per line 15 limes-\$2.00, 6-11 limes-\$1.60, 12-26 times -\$1.40

SERVICES, SUPPLIES, COURSES, AND ANNOUNCEMENTS lales per line 1-5 times-\$2.60, 6-11 times-\$1.95, 12-26 times-\$1.75

STUDENT OPPORTUNITIES for special rates, query Robin Little, 800-424-2488.

POSITIONS AVAILABLE

Associate/Electron Microscopy Canier at Texas
ALM University invites application for the position
of section relative application for the position
of section relative application for the position of section relative applications are applications. de Miniversity Invites application for the position of section microproba apociettat. Applicante should possess a working knowledge of WDS and EOS specionelers and accompanying computer and Minister programs and preferably have had experience in the geological actiones.

The primary duties of the position are to oversee and mentain [with the aid of service contracts] the section microproba and ancillary equipment and to

seem microproba and ancillary equipment and to said to leaching graduate course laboratories said specifically with electron microproba analysis. Salary will be a maximum of \$20,000(12 months: Applicant should send supporting date and letter

D. E. L. Thurston Texas A&M University Biological Services Texas A&M University
Biological Sciences Building
Colege Station, Taxas 77843
Texas A&M is an equal opportunity/affirmetives

Engineering Geologist/Geophysiolst.
The Dapertmani of Geological Sciences, University of Seskatchewan, has a vacant tenurabla posilion in enginearing gaology/geophysics. Applicar ahould be qualified to teach undergraduate and graduata courses and to conduct research in engigraduate consists and to structural geolo-gy may be appropriate. Wall-equipped lacilities are evallable for research in rock mechanics, liuid flow through porous madis, acoustic, and alectrical properties of rocks, and permatroel. Good opportu niles exist for joint research with qualifications and experience. Send applications, detailed personal resume including the nemes of at least three refer ees, and other supporting data to Or. W.G.E. Caldwell, Head, Department of Geological Sciences, University of Seskatchewan, Saskatoon, Saskatchewan, 87N GWO.

Please note: until November 15, 1991 consider ation will be given only to applicants who are Cana-dians or landed immigrants, efter that date all appli-cations will be considered.

Feoulty Positions: The University of lowe. The Department of Physics and Astronomy enticipates one or two openings for tenure-tracleculty in August 1982, One or more visiting profes sorships, et any rank, are also expected to be aveilleble. Preference will be given to candidates with research activity in the following experiment and theoretical areas: astronomy, astrophysics, atomic physics, condensed matter physics, elementery perticle physics, nuclear physics, plasme physics, and space physics. The positions involve undergraduete and graduate leaching, guidence of research students, and personal research, interes persons should send a résumé, a statement of re urch interests, and the names of three profeselonal references to Search Committee, Depart mant of Physica and Astronomy. The University of

lowe, lowa City, IA 52242.

The University of lowe is an equal opportunity/siirmetive action employer

Research Positions are Invited for two possible research positions in the Institute for Geophysics. University of Texas at Austra, an equal opportunity employer. Both positions involve field work on selsmograph networks in Letin American countries; enalysis and interpretation of data acquired from these networks end related seismological studies in the Caribbeen

and South America. One Ph.D. level and one B.S.M.S. level post-One Ph.D. level and one E.B.M.o. revel pos-tions are available. Salary for either position will be arranged depending on experience. Please sand Resume and Bibliography to Tosimeti Matumoto, Institute for Geophysica, University of Texas at Austin, 700 The Strand, Galveston, Texas 77550.

Assistant/Associate Professor Mackay School of Mines University of Nevodo-Rena

The Department of Geological Sciences invites ons for the renura track academic year position of assistant or associate professor of Ge closy to teach undergraduate and graduate courses IM.S. and Ph.O.I. Wa are seeking an o standing person with potential for teaching, establishing new laboratories and conducting and supervising research in the Basin and Range and adjoining Provinces. Publishable research will be expected. Areas of expenses within geology whice will receive lavorable consideration are structural geology, sedimentology, stratigraphy and carbon are petrology.

The position will be filled in orther January or August 1982, depending on the availability of candidates. The Ph.D. or equivalent degree is required. Salary and rank will depend on education and experience. Candidates should send a letter of ion. list of D leaching and research interests and transcripts and should arrange for at least three letters of r erence to be sent to the Department. Closing date for application is November 15, 1981. Appl cations are to be sent to: Dr. L. C. Hsu, Chatt man, Faculty Search Committee, Department of Geological Sciences, Mackey School of Mines, University of Nevada, Reno, NV 89557 University of Nevada is EOE/AAE.

Ocephysicist. Faculty position for 12-month, lenure track appointment. A sec-going marine sels-mologist with interests in seismic reflection, refrac-tion or microseismicity is sought. Candidates with strong backgrounds in non-marine selemotory or other branches of marine geophysics will also be

Duties include maintaining active research programs and obtaining outside funding, teach graduate courses and supervising graduate alu-dents. Rank je Associale Professor.

dents. Hank is Associate Professor.

Applicants who meet all requirements, but have less experience than is normally required for Associate Professor rank, will be considered for appointment at the rank of Assistant Professor. Salary— \$24,000 to \$37,000, commensurate with experi-

October 1981 to G. Ross Heath, Dean, School of October 1981 to G. Ross Heath, Dean, School of Oceanography, Oregon State University, Corvelle. Oregon, 97331 OSU is an allimistive action/equal opportunity

Poeition in Reflection Selemology: Rice University, Housien, Texas. The Ospairmani of Geology plans to expand its geophysical program Emphasis will be on reflection seismology. At this time applications are for the first of two open faculty positions. The successful applicant will help in the search for and selection of the second

Isculty member
Your main responsibility will be to last our department into the area of modern railection seis-mology. Your main teaching end research interests should be in the acquisition and processing of raflection seismic data. You should also help in devaloping rigorous undergraduata and graduata cur-ncula, which are supported by the traditional strength of the Math Sciances, Physica, and Electrical Engineering Departments at Rice. Enthusiasm to work with and undertake some joint projects with

our geologists is essentist

Our plans are to acquire e computer system configured for high quality data processing. Substantial seed money for this lacility is already in hand. Creative concentrative with the oil and conchessed in alive cooperation with the oil and geophysical inoustry in Houston, including a reasonable amount of consulting, is encouraged. Salary will be commensurate with qualifications and experience. Please send your curriculum vilae, e summary of experience in seismic processing, e statement of research interests, and names of three or more relerences to Dr. A. W. Bally, Charman, Department of Occlogy, Rice University, P.O. Box 1992, Hous-ton, Texas 77001. Application deadline—October 1

Rice is an equal opportunity employe

Petroleum Geophysicist/New Zealand
Geologicsi Survey. New Zealand is undergoing major expansion of its energy resource investigations including prospecting for hydrocarbons. The
Department of Scientilic and Industrial Research,
the principle Government R & D Agency, and advisor to povernment and industrial industrial necessary. the principle Government Fi & D Agency, and advisor to government end industry in actence and technology, has a vacancy in its Geological Survey for a selemic interpreter. The position, in the Petroleum and Basin Studies Section requires a potson with a sound geological background primarily for regional enalysis for the Basin Studies Programme.

Qualifications: A good 4 year bachetor's degree or higher, and at least 3 years petroleum explora-

on experience, are preferred. Selary: A salary of up to NZ\$23,520 per annum is offered for this position, depending on qualifica-

tions and experience.

Further information, application torms etc., may be obtained from the Ambassador Extraordinary and Plenipotentiery, New Zealand Embassy, Washington D.C. Applicants should quote Vacancy No. 2557 and forward applications, accom-

The Ambassador Extraordinary and Plentpo-

tenlary New Zealand Embassy Observetory Circle, NW Washington DC 20008 United States of America

Closing date for applications November 3, 1981:

Qaaphysioisti North Cecolina Stala Uni. vacalty-Raieigh. The Occarment of Magnir Earth and Atmospharic Scionces is reopening the search to life a presently available territo track position in ijeophysics. Flank is at the Assistant or Associate professor level. A Ph O is regimed

Primary responsibilities will include generaling and conducting research programs as well as teaching graduate courses in generalistics. The dispartment currently consists of 31 require faculty mambota including 16 in the arons of geology and neophysics. Pionog conditiosumo and names of e loteronces to J. L. Langfolder, Head, Ocpartment of Manue, Earth and Atmospheric Sciences. North Carolina State University, Religion (IC) 27850. Coadline for roce-pt of applications is On-Combar 1, 1981

North Carolina State University is an equal op-

University of Colliornie, Sente Sarbere/Assistent Prolesece of Geography. Tonure track position available July 1, 1882. Ph. 0, required prior to appointment. Strong commitment to reasonable and leaching and good background in coinputer and multi-matical quantitotivo skills required Major area of specialization should be cartography with office research and teaching interests in human geography. Submit rasunto, bibliography, and names of three referees to: Dr. Reginald G. Golledgo. Chairmon, Department of Geography. University of California. Sanin Balbaro, CA 93106 Closing date: Oecomber 31, 1991.

Equal opportunity informative action on protovor

University at New Orlaens/Galophysicist. Applications are invited for a permanent laculty po-sition commoncing August 1982, in ospioration geophysics. The Ph.O. or equivalent experience is

Appointes will be expected to teach graduate and undergraduate courses in Oeuphysics and Oonerni gaology, conduct a program of resuarch, 611pervise theses and eversee a program in geophys-ics. The position will be nt the assistant professor. level or higher doponding on background. Applicnbotto nin cricouraged from individuals with industrial experience, including recent retireas

Applicants should send a lotter outlining interes In position, complete résumé, and three letters et mmaedation to Or. Goldon Frey, Oppartment of Earth Sciances, Lake Front, University of New Orleans, New Orloans, LA 70122

UNO is air equal opportunity affirmative-action amployer. Applications from minority groups are

University of Hewell-Psculty Positions. Tho Department of Geology and Geophysics and tho Hawnii Institute of Geophysics have openings for the 1901-1902 academic year. Flank is open de-pendunt on qualifications. We are seeking persons who will participate in our teaching and research program in any of the following areas [1] structural geology and marino tectenics. (2) hydrolegy and anginaering geology. [3] matino objetiology, mag-nalics, and gravity. To apply send a latter of interest, a current vita and 3 latters of ratoronce to Or S O Schlanger, Chaumen, Department of Goology and Geophysics, University of Hawair, 2525 Corroa Road, Honolu'u. Haweii 96822 (809-948-7520), or Or. C E Helsley, Orroctor, Hawaii Institute of Geophysics, same address (808-948-8760). Open until

The Unr. eisity of Hawa: Is an affirmative ection and equal opportunity employer

Faculty Position: Environmental Engineering. Eleg ... ng January o: September 1982. The position requies undergraduate and graduate teach og and sponsored research activities in the areas of water quality control end water resources.

An earned doctorate is required and at least one degrae in civil engineering is preferred. Flank will be at the essistant professor lavet and selary will depend upon qual-fications Apply to: Or Lesiar A Hoel, Charman, Department of Cryll Engineering, University of Virginia. Charlottesville, Virginia

An affirmative action equal opportunity employar.

Faculty Positions in Earth Sciencer Syraquae University. The Constraint of Geology ivites applications for four trinure track positions a the level of assistant protessor to be fifted after Jonuary 1982. Outstanding applicants from all arons of earth science will be considered. Candidates sperinlizing in low-T naugous deochomietry, struchiro lectorics, solid-earth geophysics, or choracal sortimentology are pulicularly welcome. Sond latter ol opplication including vita, statement of research and teaching interests, and names of 3 references to John Olckey, Chairman, Copertment of Geology. Heroy Goology Enboratory, Syracuse University.
Syracuso, NY 13210. Applications will be accepted

Syracusa Unicarally II an equal opportunity/affirmatwo action outployer

until thaso positions ere trilad

City University of New York, |Srooklyn College): Feculty Positions. The Department of Gaology anticipates filling several tenuro track positions at Full Professor tevel. (Selary range up to \$43,4001. Highly qualified individuals will be considered for distinguished appointments at an additional \$5,000

While candidates who have distinguished themselves in any fiold are wolcome to contect us, we are particularly interested in openings in: anergy re-sources (coal-petrolaum), exploration geophysics, environmental geology or hydrogaology, coestal sedimoniology, economic geology. Successful epplicents will be required to institute

an octive roseorch program, aupervise Master's end Ph.D thoses. Nominations and applications with current vilne should be sent to: Or. O. Challe chani. Chairman, Capt. of Geology, Srooklyn College of City University of New York, Srooklyn, New York 11210. Positions open until lilled.

Crooklyn Collego, CUNY, is an elfimetive action:

Research Position in Chemicel Cossnogra-phy. Cruiomio thelitulo of Tochnology, Ovision of Geological and Planetary Scionces. The position of resourch follow is being offered at Calloch for tosoarch in occarnography. Invostigation of the isotop-ic composition of naodymium end rare earth abun-dances in sea weter and sediments is now being corried forward. The machenism of injection of REE into sea water will be studied. The differences in

"12"Nd in verious water messes [Plapgras et al., Earth and Planot Sci. Lott. 45, 223-238 and Prapgras and Wasserburg. Earth and Planet. Sci. Lett 50, 129-139 (1980) Is now being carried forward as an exploratory vanture in order to delar-mins the origin and chemical behavior of REE in the ocean and the potential usu of 143Nd/144Nd as a trocor. The laboratory facilities for sample piage elion and anetysis are fully functional and will be evailable Applicants should heve training in ocasn-ography and a good perspective on general physical occonographic models. Sond resume and references to Prolessor G. J

Wasserburg, Lunatic Asylum, Celifornia Instituto of Technology, Pasedena. CA 81125 Caltech is an aqual opportunity/affirmative action

Assistant Professor Dapartment of Goology, University of Vermont. The Geology Department at the University of Vermont is recruiting for a tenure track position at the assistant profess level to begin September 1982 Field of epecialize tion about complement existing faculty expertise in petrology, etructure and regional geology. Applica-tions are solicited le, but not restricted to, geophysics. Igneous petrology geochronology, hydrology Presiocene or economic geology. The eucceesful candidate will be expected to develop a research program involving both graduale atudents (M.S.) and advanced undergreduetes. Applications will be accepted until Oecember 1681.

Cend-datae should send resume and arrange to three lettere of reference to be sent to:

Acting Chairman Department of Geology University of Vermont Ourlington, VT 05405

The University of Vermont is an equal opportunity affirmetive action employer

- EARTH SCIENCES -

The Lamont-Doherty Geological Ob-

servatory of Columbie University invites scientists interested in eny field of the earth sciences to epply for the iollowing fellowships: two postdoctorel isllowships, each awerded for a period of one year (extendable to two years in speciel instances) beginning in September 1982 with e slipend of \$22,500 per ennum. Completed applications are to be relurned by Jenuary 15, 1982. Application forms mey be obtained by writing to the Director, Lamont-Doharty Geological Observatory, Pelisedes, New York 10964. Award ennouncements will be made February

28, 1982 or shortly thereetter. The Observetory eleo welcomes epplications from cendidetes for poeldoctorel research esecciele positions in this disciptine.

Speae Physics Research Position. Appl canto with beckground in Interplenetary epace, auroret and megnetospheric reasarch, and/or space instrumentation are sought. Successful candidates will work with I@EE particla deta end/or with suroret X-ray imaging research that uses the newly davel-oped X-ray cernains. These positions have not been lilled and are available now. Sand your resume to Prolessor George K. Perke, Spece Sciances, Geophysics Progrem, University of Weshington. Saalla, WA 99195.

The University is an equal opportunity employer

Saniar Fegulty Position: Metageology Applications and nominations are lawited for a sen-ter lacuity position in maleorology, at the University of Utah. Eligible applicant will also be considered for chalperson of the department. Cendidetes must possess e Ph.O. In meteorology or a releted disci-pline. Applicants should have isaching and research experience and be interested in perticipating in both the graduate and undergraduate programs Applicants should submit curriculum vitee and

Or. Jan Paugla Search Committee Oaparlment of Mateorology University of Utah Sait Lake City, Utah 84112 Deadine for applications November 30, 1684. The University of Ulah is an affirmative ection.

Atmosphoelc Scientiat/Geoup Head. Senio stall scantist position available immediately at the NAIC's Arecibo Observetory. The successful applicant will be appointed as Head of the Armospheric Sciences Group and will be expected to lead that group and to perform independent reaearch using the Arscho lacilities. A Ph.O. dagres in elmospher ic or physical sciences or rader engineering and a record of solid research accomplishments are required Experience with rader studies of the stretoaphere, mesoaphere, and lonosphere or with HF modifications of the ionosphere is destreble. Salen open. Please sond resume end names of at least three referencee to Or Harold O Craft, Jr., Acting Ofrector, NAIC Observatory, Space Sciencee Building, Cornell University, Ithace, New York 14853. NAIC Cornell University are EOE/AAE.

Californie Space Institute: University of Calliomie, Sente Sarbece: Rascerch position in Ramote Sanaing. Basic end applied research in come combinetion of remole sensing of cosstal zonea, land use lend cover, neturel end eg-ncultural vegetellon, end soil moisture with skille in information systems, automated Image analysis, and quantitetive modelling. We seek en Indepen-dent worker with the goal of deepaning and widen

ing existing work in these ereas on this campus. Ph.O. preferred. Hank and selery commensurate with experience. Closing date: November 30, 1961. Submit: resuma; a brief account of recearch interasts; and names of three professional relates to Oi. Cevid S. Simonett, Department of Geography. University of California, Santa Berbara, California,

GAP

dols when ordering.

Separates

To Order: The order number can be

found si the end of each abstract; use all

Cost: \$3.50 lot the first srticle and

\$1.00 for each additional article in tha

same order. Psymeni musi accompany

Deposit Account: A minimum ol

\$10.00 may be placed on deposit with

AGU for the purchase of separates. It funds are on deposit, the cost of the first

article is only \$2.00 and \$1.00 for each

Senerales will be mailed within 3

weeks of journal publication or within 10

days if ordered after the journal has

appeared. Separates ere evallable for

purchase for two years from date of

Copies of English translations of srti-

des from Russian translation journals

are available either in unedited form at

the time of their fieting in EOS or in line!

printed form when a fournal le published.

The charga is \$2.00 per Russian paga.

American Geophysical Union

2000 Florida Avenua, N.W.

Washington, O.C. 20009

IS Burdary Layer and exchange processes and FRUMAL FORWATEN DIE TO ENGLISH WHITER MILDS ETFECTS AS GESTRED BY EASTLAINE AND FRUITS SA A NUFBECCL MODEL.

B. Cancod, Jr. (Doct. of Commongraphy, and Fortgrachates School, Huntaursy, CA. 53940)

E. W. Fett, K. K. Rebe and H. M. Brandli.

Dring the winter season, infrared data from Macrological schallites reveal the outlines of Atlans Barks as cold areas conforming to the Act winter season, infrared data from Macrological schallites reveal the outlines of Atlans Barks as cold areas conforming to the Act winter season, infrared data from Macrological schallites reversed in number when the Banks appropriate are shown at a medium school in under some and an endinguational numerical model is used to inviligate the effect of wind and benparature from the suiden passage of a cold-front cough the area. If is found that such an our results in shalles weber cooling producing infact temperature fromto and mild salinity unditing regimines the affect (shellow weber willing, remote sensing, temperature achinity).

'Carbon, Ess., Erten, Paper 101186

Oceanography

Send your order to:

withional article in the same order.

The University of California, Senta Berbara, is an equal opportunity/Affirmative Action employer

PETROLEUM DEPOSITE. If you are financing, planning, designing, exploring, drilling, or digging in connection with any form of energy, you need this complete, up-to-deta book about the world's petrolaum deposite. Includes production and reserves for areas. Herdcover, 6 - 8 inches, 378 pages. Tabls of contents, drewings, Index, references, 1974. \$50. Teisch Associates, 120 Thunder Road, Sud-

STUDENT OPPORTUNITIES

Greduate Study in Space Physics end Astronomy. Rica University is pleased to offer Fellowahips for enlering greducte cludents in the Op-partment of Space Physics and Astronomy. Excitng research to underway in the fields of inspretical and experimental epece plasme physics, magneto-sphares of the earth and planets, etmospheric and loncepheric physics, leboratory studies of Rydberg eterna, leser reseerch, epace soler power studies,

and eatronomy and eatrophysics.

The tellowehips for first year students presently are \$4545 taxtee for 8 months, plus tuition, and involve only 4-5 hours tutoring, grading, or instructing par week for four semesters. Research assistanceships for aummers and subasquent years are generally evallable at \$550 per month. Students with exceptional undergreduate records and GRE scores are eligible for an additional \$1000 Presidential Recognition Award. Reisea are expected for next yeer.

Address inquiries to: Or. Petricia Reili, Assistant Chairmen, Oepartment of Space Physics and Astronomy, Rice University, 77001.

Research Assistentship in the Study of Annuel Ice Covers. Research assistantahinta for greduate study leading to the M.S. and for Ph.O. degrees with emphasie on the aludy of the growth end decay of annual ice covers may be aveilable. Hydrological, geophysical or angineering aspects of annual ice covers may be lopics of reirch. Giudenta with beckgrounds in physics, mathemetics, hydrology, hydraulics, and angineering are desired. For further details, contact Professor T. E. Oaterkamp, Geophyalical Institute, University of Alaska, Elvey Oldg., 903 Koyukuk Ava., North, Feirbanks, AK., 99701 (Tel. 907-479-7548).

Permetroat Geophysics Assistantships. Research easistsniahips for graduate study leading to the M.S. and for Ph.O. degrees in the area of permatrost geophysics may be eveilable Students with backgrounds in physics, soil physics, mathemetics, geophysics, geology or engineering are desized. Fletd work may be required. Possible study topics include virtuelly all espects of parmafrost geophysics research from detection and mapping to physical properties. For more information, conlact Professor T. E. Oaterkamp, Geophysical Instiute, University of Alaska, Elvey Gldg., 603 Koyukuk Ave., North, Feirbenka, Aleske, 99701 (Tel.

Chemical Oceanography Asalstantships. Several research essieteniships for graduale slu-dente in chemical oceanography are evalishe from the School of Oceanography, Oregon Sista University. Research topice may cover enalyticat, descrip-tive, inorganic, organic, physical, geo-, and radio-chemiatry and radioacology. Seginning master's students are offered \$546 a month plus taltion and beginning PhO studente era offered \$584 a month plus luition. Students with undergredueta er greduete freining in chemietry, chemical engineering, and oceanography ere encouraged to apply. Additional information may be obtained from the Student Advisor (503-754-3504) School of Oceanography, Oregon State University, Corvells OR 97331.

houndary layer. The poster sperre of U and W hats processed easion of the fraquency of the water creaters past, Rowever, these wave induced companions a support livite depended across coving re the phase difference of 90° between U and W about generation of large expected acrosses to shout generation of large expected acrosses to intermitteerly observed in the 10s cerims of U111 x Will . They occur as windward or leavend points close to the create, indicating that close reconstrict on the size that close seems to the creater of the size that close reconstrict on the size that close reconstrict on the size that close reconstrict on the size that close a construction of the sums of the size of the benefit phenomena over a smooth eath. Inchessed the benefit layer, Vind serre, Wind says tensel, suresting fact, Sep. Thous better 38: 5 170hes beophyc. Journ. 1, Vol. 78, No. 1, 1981

a710 Chumical occanography
bi673184710N OF NYONOTHERMAL MANSARESS OVER THE
JEAN OF FUCA SIDCE
C.J. Jones, S.A. Johann, and J.S. Delsony (Dept.
of Occasegraphy, University of Nushington,
Santtle, Kashington 98194]
Sorton waters know five hydrogatephis stations,
speed equally sings a 500-km secriom of the Juan
de Fuca Ridge morth of the Blanco Frature Zons,
contain smomnlously high concentrations of Total
Dissolvable Mangamese | ITM4. The two bottom-most
bettles from earh hydrocast | 'libit to 20th a bova
bottom; from earh hydrocast | 'libit to 20th a bova
bottom; from earh hydrocast | 'libit to 20th a bova
bottom; from earh hydrocast | 'libit to 20th a bova
bottom; from earh hydrocast | 'libit to 20th a bova
bottom; from earh hydrocast | 'libit to 20th a bova
bottom; from earh hydrocast | 'libit to 20th a bova
bottom; name from 8.3 to 1bh, 9 mon kg-1 with a
cousely a fartor of 10 higher than claitice nearbottom samples obtained from two off-mais locations. Analogy to work on the East Pacific Bise
leptins that hydrocharmal set lytty slong the
ridge smis is a sectributing smbsattlely to the
sampense romann of the water column in this
portlon of the cortheastern Pacilla.
Coophys. Res. Leit., Paper ILIO74 phys. Res. Lett., Paper 111074

71) Circulation 4 ESTIMATE OF ASSOLUTS GEOSYROPHIC VELOCITY FROM HE DEFOITY FIREL DA THE BURTHUSTEAN VACTFIC

SETIMATE OF ASSOCIATS GROSTROPHIC VELOCIty FROM THE EXTREMSTRAN FACTFIC OCSES

O. Coats Isorips institution of Oceanography, is Joils, Calif., 920931

I pair of hydrographic sections 1350s, 1550st wars analyzed to couplet absolute relocity by using a carlatico of the technique adamend by Sociami and Schoff 19771. Abtolets salonity is detarmined from a isfagrated form of the pofamical vorticity equation by a technique magasted by Social 19781. This study is the first application of this technique that allows a direct comparison between the wearfaiety in salienting a shooth density field wed the amount of labelsons in the system of equations is fer senter than is allowed by the uncertainty is defining the smooth field, the model equation is considered adequate for this and of data. Below 6th s, the nearly constant socal loopyconel alone indicates that pofactal vortinity is uniform so loopycoal surfaces, fined the model equation is considered adequate for this said of data. Below 6th s, the nearly constant rocal loopyconel alone indicates that pofactal vortinity is uniform social and flow directions from the intersection of leopyconels and surfaces in this region. The model equation does, however, constraint his structure of the saridional densify field with a which a wocessively deaper 1 sopyconis reach that maximum depth. The fact that thit polesard terministion on the predicted ower second the Worth Peaclife subtropleal agree. This polesard transistion of the density fields, in general, and coours in conjunction with a transistion in the lited of geopotactial anously, it is directly related to the ourceture in the desportice of the beta spirat. Ibeta apirali

J. Ocophys. Rea., Green, Paper 101092 J. Geoghya, Res., Green, Paper IC1092

PIL CLICULATION RED-PEVIL ENTRUSIONS AT THE CONTINENTAL SHIFT PARTICULATION AT THE CONTINUAL SHIFT ENG.

A heigh IVErginia intersiste of Marine Science, Clausearor Possi, Vitarinia 20021
Charcestor Possi, Vitarinia 20021
Charcestor Science the continuant shell citation in the second seco

PIT LOUGHTY LEYBY AND CONTRACT LAYED GYEN WIDD LITTE IN a VIND VARY TUNNEL. 5. LANGER (Grophysical Localetata, Farmity of Sidney, Tehnic Universal Contract, Sunday Ind., Japan K. 1846. 6. Lacat and T. Toba Birmers of the terbolant air liou is immersed to a wind ecua unneal, under the distribution where hoth the cind cause and the folders benefity layer over them are desucioning. It is found that looking benefity layer over them are desucioning. It is found that boundary layer is insider to that over a flat plate in some imposts, it also attribus one posts and the research of fluster it is a factor of the course of fluster in the portion of fluster iteras centerfloot. The mean valuality will near the vind veves are similar to that are also in the present of the boundary layer. The valuality faint lay is an entire the confirmed a though the Form its flightly different from these fall known for a flat fifth, dilloogh the terbalant thatesettes [UP] it is in a first flusted by vind veves, a reading of tention that welco in Ure [-UW] and into corresponding to the legarithmic layer. The values of Ur are Ji till at the infectious and thy determined by the basisty Styr locaress eith devalops of the Izvestiya Atmospheric and Oceanic Physics

Volume 16, Number 11

CONTENTS

Galla M. B., Kirlehkov S. E. On the Oscilletion Cyclo Theory of the Zonal Cirrulation of the Almosphere

Seriation of the Almosphere

Authority G. P. Krupehatníkov V. N., Lenekínov N. J. On Simulation of an Aonasi Cycle in a Low-Component Model of Climete

Notilitky M. A. Influence of Streiffication on Diffusion of a Cloud of Poliutanis in the Plant Poliutanis in the Planetsry Boundary Leyer

Andratyev K. Ya., Moskefenko N. I. Evolution of the Eerih's Almosphere and the Greenhouse Elieci omanovs L. M., Terebukhine I. M. On Reflection of Light by Homogeneous Cloud by Horizontelly Inhomogeneous Illumination
Letkov S. P. kiedel of Seturated Spectrum of Internal Waves
Volkey Yu. N. The Modelling of the Et Nino Physoomenon by an Antooscillation
Process in the Ocean — Atmosphere System
Reliative M. H. On Scattering of Falling irrediction on the See Surface Section.
Rysbian V. E. A Model of Non-Stationary Thermoheline Circulation in the Ocean of Finite Denth

NOTES

an of Finite Depth

Regisency S., Vidency P., Diency-Kickey Y. I., Tersbukhin V. M., Fokoyeva E. V. Speciroscopic Messurements of Beckground Content of CO, GH₁ and N₁O over Rulgaria Medical States of the States of the States of the Interface het ween Two Fest Oscillating Flows 1214
Mirching N. R. Pelinovsky E. N. On the Connection of the Tzunemi Wave Perind in the Neer Shore Zone with the Size of the Source nic Upper Layer Temperature Structure in the Mid-Atlantic Ares 1220

CRITIOS AND BIBLIOGRAPBY

Malveyev L. T. Book Review: Report of the IOC Study Conference on Climato. Medele: Performence, Iotercomperison ead Sansitivity Studies (GARP Publications Series, No. 22, December 1979)

Khagian A. Kh. Book Review: Stratospherio Ozone, Deplotton by Hejecarbonos: Cherofetry and Transport (Nellonel Academy of Sciences USA, 1979)

OHRONIOLE

Wiglan A. Kh. Agreement between World Meteorological Organization and fn-tenstional Council of Scientific Uniona.

Oceanology Volume 20, Number 5

CONTENTS

Acodemicion L. A. Zenkevich 1889—1970 Filintono Z. A., Pinograndon N. G. Academician L. A. Zenkevich multilist role in the development of the ocean schuce Vinogradous N. G. Acodemician L. A. Zenkevich's teaching un the biological structure of the ocean Listizin A. P. Works of L. A. Zenkevich and the development of genlogy of the sead and oceans Ross T. S. Symmetry and osymmetry of oceanic lehthyolanna	757 758 766 774 783
Physics of the sea	
Zhitkovsky Yu., Yu., Mozgovoy V. A. Deep-scallering layers in the ocean (a review) Mokin V. K., Chnilkou D. V. Laborstory etudies of wind-driven waves Volkov Yu. N. Thermodynomic long-term occillations of the ocean and the atmosphere in the North Pacific Ginzburg A. I., Zolsepin A. G., Sklyarov V. E., Fedorov K. N. Precipitation effects in the uppermost ocean layer Dikinov Kh. Zh., Zholudev V. D. On calculations of the drag coefficient and wind ofress at the sea surface	792 806 818 828 837
Morine chemistry	
Gazelyon V. L., Atzniutila T. A. Adsorption of protein enzymes on suspended matter of the sea water Propp L. N. Scasonal distribution in dissolved and suspended frams of the Cu., Min and Zn at a permanent station in the Visite's fault of the Sen in Japan Smirnou B. A. A general scheme rel hydrogathous formation during organic matter sedimentation in the World Ocean	844 850 854
Murine geology	
Gerosimov I, P. The Ostwin Rise (thalassociation) in the Pacific Decan and its associated peleogeographic problems Snuosita L. A., Volokiliar I., P., Zonenchnia I., P., Sociokitia O. G., Satiova Kh. etc., Sedov A. P. Peleobuthymetry of the Pacific Ocean in Late Cretaceous period Verzhölisky E. V., Zolotareu V. G. Heat they measurements in the rill zone of the Red Scs Ionia A. S., Medvedev V. S., Pavialis Yu, A. Marpholithogenesis and its types in the shell zone of the scas and oceans Avenains I. G., Ounoev N. N., Yurkevich M. G. A morphostructural analysis of the near-shore shell zone of the nurth-eastern Black Sra	806 871 882 887 894
Marine biology	
Krupatkin D. K. Light intensity effects on cell sizes in planklonic algae during their adaptation to light. Glebou B. V., Kolosoua F. G. Berurrent groups of the experional species Calanoida in the northern subtropical gyre of the Atlantic Ocean. Zelickman E. A., Lukashevich I. P., Orobysheva S. S., Degivern A. A. Elimination of the eggs and larvae in the Harcitts Sea crustaceans Thrannessa therms Kr. and T. raschill [M. Sars] (Euphansiacea). Shishkiun E. A., Musaeva E. I. Energy equivalents of body mass of marine zooplanklers as dependent on their sizes. Rudyakov Yu. A., Isulia V. B. Passive sinking rate in marine pelagic organisms.	902 909 912 92:
Observational methods and instruments	
Pannonou A. N., Grekov V. A., Ivanou A. F. A lowed measuring system for investigating integral temperature variability in the upper ocean layer. Kosov A. E., Konnou V. A. The use of low-selective electrodes in oceanographic studies. Klyueo V. A., Shekhostov O. V. A small-sized ferrosounding direction meter	94: 94: 94:
Negman V. G., Kharkov O. I. The International Symposium on the Soviet-Ameri-	
Can Programme POLYMOOE Paka V. T., Birbnov V. A., Pozdymin V. O. The 24th cruise of the research vessel «Dmitry Mendeleev»	954 954

4785 Surface wause, tides, and see launt
EXPERIMENTAL STUDY ON STREES INTERACTION SETVENN
EXPERTED WAYES AND YAUDE WAYES—"I
T. Isad (Geophysical loatinte, Servity of
Salence, Thhoku Daiversity, Sendal 980, Japan)
M. Haterl, M. Tokude and Y. Toke
Experiments on avolution of a ware field, when
the sind blows over a temin of machesizally
goustand ragains wave, have been performed to a
wind-wave tuber! Among four stages of the
avoistion already described in the prevaiting
opper (tater) at al., 1981, the package from the
first to the amond etages, where attrouvation of
local wind waves and simultaneous growth of
sagniar were hegin to take place, has been
investigated to detail. Statistical investigation waits individual-wave analgais terhiques is
made. Amelyses maing the phase firstion of eind
wave diagree above a riser spatement to the office
wave diagree above a riser spatement to the office
tracing avoistion of local eind seven eigh respecto the phase of co-mining vegular was suggest
that the atcomp lotteration occurs among the
regular waves and one or two creates of local wind
waves incepted near the trast of the regular see.
(Water waves, eind waves, etc. 35th the file as the office of the server.)

Particles and Fields Magnetosphere

5775 Frappad partials OSSISVATION AND HODELISO OF SECRETIC PRITICLES SY STRUCEDHUS ORDIT ON JULy 29, 1977 O. M. Baker High Alemon Estimos interatory, Les eleman, M. 879551, f. S. Felts, A. Althern, P. t. Highis, A. C. Kaye, C. O. Kicalson, F. S. Moote, W. Stidenson, A. J. Manlay, P. C. Smith, and A. I. Mannada It is also concluded from the ghase space decating studies that "Great" particles with imagestic scools up to at least several hundred MeV/gauss were lajected near genetations rated in it. The pracos adiabatic someofic model are supplet the observed (ejamite of large eggestic scenar periods from the places effect to a generation orbif affrough physical always of the normal codel swaf be attered scenario.

J. Geophys. Res., Sius, Faper (Allis

5780 Wass Propagation

PRESERVED SIGNATURES OF ION FELD MODULATIONS OB-SERVED BY ATS-6

S-Y Sv [Lockheed Engineering and Management Services Co., Inc., Houston, YS [7050] A. Koaradi and C. A. Frits

on August 13, 1974 the ATS-6 NOAM lestrument in generationary orbit observed outsitation a lew hours after local midelphi in the fluxes of local row 24 keV to 150 keV (five calennis) which hid three services of the otestical liret, the starting characteristics liret, the starting characteristics liret, the starting characteristics liret, the starting characteristics and the high sarrey channels and detected progressically later to the lower energy channels. Second, the outliation frequency was higher for the highest energy ones and decreased with the lone energy the multiple frequencies appeared to be discrete and hermonically related. Third, the deretion observed but seemed by the first the figure the localitation, was energy dependent; the higher the localitation. We senciude that the flux modulations did not start to the region where they were observed but were actually the preserved signatures drifting to longitude of flux modulations resulting from ware-partials resonant leteractions which occurred at an earlier time to a region shalt of flux modulations of the kind are saidom observed, the crifting lone are apparently capable of preserving the signatures of the flux modulation effort they leave the thereaction region. The interestion region is the injustice of the line sector from near anditable through the moon meridiae, to the tetemoning hours.

J. Goophys. Sest., Siss, Fapar tabilas

morality hours. J. Googhys. Sas., Sign, Paper thilds

STRO Wave propagation
LEARY MAYER SUPPOSTED BY A EQUARE WIRE MISH WITH
ROUNDS JUNKTIONS ABOVE A SEARTIVE SERVACE
A.M. Sathbora (Certon de Análise a Proceagements
de Siacie, Complexo infardisciplinar, instituto
Buperior Tecnico, Au. Soviaco Pala, 1998 Lisbog
Codea, Sottugali, A.F. dus Santor sad J.Figanlor
The mode; mywarioo of e aquece bonded mosh of
this conducting wires our e resultive piene is
deriand end smixed numericplip by e troinique
which yields mil the roots withle 8 alvan seoton
of the transvate eare number place. Primer
salority sod attenuation regulator by the lowest
order leafy sere ones is beforess en function
of ones harderers, seriera impedance of abo
tarativa plane, frequency and direction of
propagation, fome legistas of the radiation
charageerintics of this excutary are scations.
When even, regulive autient, ison wased. Pad. Sci:, Paper [5]|Bl ..

Meetings

Yosemite Conference on Magnetospheres

Preliminary ebstracts for the 1982 Yosemite Conterence entitled Origins of Plesmas and Electric Fields in the Earth's Magnelosphere' are due October 3f. The conference is scheduled for January 25-29, 1982, at The Ahwahnee in Yosemife, Calif. Extended ebstracts (four pages maximum length, including figures) are due November 30.

The conference will addrass the nature of plesme sources end electric fiold generators within the magnetosphere. Sources of magnelospheric plasma wifl be discussed in context of the solar wind, presmasphere, and ionosphore boundary source regions. In addition, the generelors of the magnatospheric electric field will be treated in two parts: Ina dynamo aepects of generating en alectric ited in the solar wind mognetosphere system and the effect of the overall coupling between lonosphere, plasmesphere, and megnalosphere on the generators.

For additional information about the conference, write either of the convenors, F. T. Berkoy or J. C. Foster, CASS. UMC 34, Uteh State University, Logen, UT 84322. Berkey's tolephona number is 801/750-2961; Foster's is 801/750-

The conference is sponsored by the Solar Terrestriel Division of NASA, Uteh State University, and AGU. 55

Earthquake Engineering Conference

The Eighth World Conference on Earthqueke Engineering la scheduled for July 21-28, 1984, et the Fairmont Holef in San Frencisco, Cafil. The conference will be a forum for scientists in all fields releted to earthquake enginearing. Conference lopics probably will include geoscience, civil and structurel engineering, plenning and regulatione, and

sociel and economic especie of serthquake engineering. The conference is sponsored by the Earthqueke Engineering Research institute (EERI).

For detells on how to submit en ebstract end register for the mealing, or to oblein other information, contect R. B. Msifhleaen, Chair-SWCEE, EERI, 2620 Telegreph Avenue, Berkeley, CA 94704. 59

ANTON L. HALES SYMPOSIUM

The Geosciences Program of The University of Texee si Dellas will sponsor e Symposium enillied

"SOME RECENT ADVANCES IN GEOPHYSICS"

on October 5-6, 1981, in honor of Dr. Anion L. Helse on his 70th birthdey.

The Symposium will consist of two deys of invited felks by ini emationally known epeekers from academia and industry on recent developments in geophysics with an emphasis on eeismology. Topics will include recent COCORP regulas, modelling reflection selamograms, helerogsneque earth structure, ettenuelion of selemic weves, and global lectonics,

For edditional details and registration information, contect Richard M. Mitterer or Ronald W. Ward, Progrems in Geosciences, The University of Texee at Delias, P.O. Box 888, Richerdson, Texas 75080. Talephone: 214-690-2401.

1981 Midwest Meeting Plan to Attend

September 17–18 Minneapolis, Minnesota

Radisson Hotel (Rates: Single \$34, Doubls \$40, Triple \$12.50 per person)

Thursday • Menlie etructure end dynamics Hydrology in the mid-continan-

 Precambrien crustal evolution of the North American continent Sedimentary peleomagnetism:

Geological history from the re-

cent to the Precambrish Rock water interactions: Hydrothermal processes and maislio genesis

